

DIRECT EVIDENCE TO SUPPORT EVOLUTION:**1. FOSSILS:** The only type of **DIRECT** evidence we have to support evolution

- Shows how organisms have **changed** over time due to changes in climates (e.g. temperature, rainfall, droughts, etc.), natural disasters (e.g. asteroid/meteorite), lack of food source, predators, etc.
- Shows how some organisms weren't able to adapt/survive and so these organisms went extinct (the whole species permanently disappears) → we know they went extinct because we have found fossils which do not resemble any known present-day species
- Shows how some organisms have changed very little over thousands to millions of years. There's no need for some organisms to change as long as they are "perfectly" adapted to their environment.
- Fossil record represents preserved collective history of organisms, tells of major changes in climate and geography and shows that change followed change on earth

INDIRECT EVIDENCE TO SUPPORT EVOLUTION:**1. EMBRYOLOGY:**

- The more closely related 2 species are to each other, the more these 2 embryos will resemble each other (at least in the early stages of embryo development) → shows that similar genes are involved
- 2 organisms which look quite different from each other (e.g. human & pig) may show similar embryological forms which provides indirect evidence of a past evolutionary relationship (i.e. they both evolved from a fairly recent common ancestor). Pigs and humans do not look that much alike but the fact that their embryological forms look quite similar provides convincing evidence that they are both mammals.

2. VESTIGIAL ORGANS:

- Vestigial organs are parts which no longer seem to serve any real useful purpose. E.g. snake's legs, human tailbone, wisdom teeth and appendix → human appendix is the remains of the cecum (the pouch which is found between the small and large intestine). The cecum is found in herbivores (plant eaters) who need a place to store large amounts of cellulose (plant material). As the human diet changed, there was no need for this extra storage "pouch"
- Our appendix still exists because organisms still have the **GENE(S)** for this trait
 - remember Lamarck's misconception → organisms can't "will" a certain body part away just because we don't use it anymore
 - **BUT** why and how did vestigial organs become smaller? Isn't that similar to Lamarck's idea of "Use and Disuse"? ⇒ **No!** By **chance**, some humans were born with a smaller appendix and these people may have had a slight advantage over those with a larger appendix (e.g. larger appendix could get infected more, takes more energy for body to make a larger appendix, etc.). These people may have had a better chance of surviving and then passed on their genes for a smaller appendix → a smaller appendix was "naturally selected" for

3. HOMOLOGOUS/ANALOGOUS STRUCTURES:

- a) **homologous structures:** parts, such as a bird's wing, human arm, whale fin, which are made up of the same types of bones (though the sizes of these bones differ from species to species) but which have different functions (e.g. wing = flying, arm = grabbing, fin = swimming)
 - homologous structures show that these organisms had a fairly common ancestor but that each organism has changed or "evolved" these bones for a different function/purpose in order to fit better into the environment in which each species lives in